ATTACHMENT 8
PREPAREDNESS AND PREVENTION OF HAZARDS

8.1 HAZARD PREVENTION PROCEDURES

Safety procedures for handling all of the munitions, explosives, and agents processed at U.S. Army Chemical Agent Munitions Disposal System (USACAMDS) have been developed from many years of chemical agent and explosive handling experience. All handling of explosives, munitions, and agents is done under strict adherence to Standing Operating Procedures (SOPs) developed specifically for the item being handled. Hazard prevention procedures also include strict adherence to inherent safety parameters designed into equipment, redundancy of safety and hazard prevention interlocks in equipment, suitability of materials of construction, explosive and chemical quantity/distance limitations, and other safety factors as defined by the U.S. Army Explosive Safety Program, AR 385-64; Ammunition and Explosive Safety Standards, DA PAM 385-64.

8.1.1 Handling of Munitions and Agents

Munitions transported from storage to the Munitions Holding Area (MHA) are handled in accordance with a specific SOP developed and approved for the munition being processed. Agent monitoring is done before removal from storage, during transport, and before unloading operations are initiated. Unloading of the van is accomplished by forklift. Munitions are placed into temporary storage in a service magazine. Munitions are moved from temporary storage to the appropriate UPA by forklift.

Ton Containers (TCs) may be lifted and transported by an 8,000 lb capacity forklift equipped with a specially designed and tested grab bar, or other means, as appropriate. Special slings have been designed for handling other bulk items.

Once munitions or agents have been inserted into the process flow at USACAMDS (e.g., placed onto or in the process feed equipment), operations on the item are isolated and automated to the fullest extent possible. These automated operations are controlled by process control systems, which incorporate extensive safety interlocking and redundant safety checks, automatic waste-feed cutoffs, and both personnel and environmental exposure monitoring. This provides the maximum safety to personnel and to the environment by limiting the requirement for personnel exposure to and handling of hazardous material. In most cases, the material being processed does not require human contact until the process is complete and the hazards associated with handling have been greatly reduced or eliminated.

8.1.2 Loading and Unloading of Solid and Hazardous Waste

Solid and hazardous waste residuals are collected from several areas at CAMDS. Table 8-1 lists some of these items, the location they are collected from, and the packaging or container.

Table 8-1
RESIDUAL WASTE STREAMS

Residual	Location Collected	Container
Metal Parts Furnace Metal Scrap	Metal Parts Furnace Discharge	Dumpster/Truck/ Container
Ash/Residue	Metal Parts Furnace Discharge	Drum
Incinerator Pollution Abatement System Brines	Brine Drying Area	Tank/Tanker
Dried PAS Brine Salts	Brine Drying Area	Drum
Spent Decontamination Solution	Toxic Maintenance Facility	Tank

A description of the handling process for each of these residuals is provided below. All of these waste materials are handled and managed per the Waste Analysis Plan found in Attachment 2.

8.1.2.1 Metal Parts Furnace Metal Scrap

Scrap metal may be sent to a hazardous waste landfill or a smelter for recycling after it has been thermally treated in the Metal Parts Furnace (MPF).

8.1.2.2 Ash/Residue

The ash/residue is collected in containers. When the containers are full, they are closed and removed to a storage area. After the container contents are monitored agent free they are moved to an approved hazardous waste management facility.

8.1.2.3 Incinerator Pollution Abatement System Brines

All incinerator Pollution Abatement System (PAS) brines are collected in the Brine Drying Area (BDA) brine holding tanks. The brines collected are processed through the brine drum dryers to reduce the water content and generate dry salts. Excess water is evaporated. The brine solutions are monitored to insure agent concentrations are below the limits specified in the Waste Analysis Plan before the drying process takes place, then every two hours during the drying process.

8.1.2.4 Dried PAS Brine Salts

Waste salts are generated at the BDA. Small hoppers or plastic lined steel drums are used to collect the salts from the twin drum dryers. The salts are accumulated in containers (typically 55 gallon, open-head, polyethylene drums) as they are generated. After a container is filled, it is sealed and held in a 90-day accumulation area prior to being transferred to a permitted storage area and then offsite for disposal.

8.1.2.5 Spent Decontamination Solution

Spent Decontamination Solution (SDS) is generated at various locations throughout the CAMDS site and is accumulated via the liquid waste collection system to the storage tanks in the Toxic Maintenance Facility. Before each tank reaches the maximum operating capacity, it is sampled and tested to insure agent concentrations are below the limits specified in the Waste Analysis Plan. The SDS may then be transferred to a holding tank in the BDA and ultimately off-site as per the Waste Analysis Plan.

8.1.3 Measures to Prevent Run-off from Hazardous Waste Handling Areas

Run-off from any of the hazardous waste handling areas is prevented by design and construction of the facilities. The floor of each hazardous waste handling facility is concrete, sloped to floor sumps equipped with sump pumps. In addition to the sloped floors and sumps, each handling area has curbs that completely enclose each area. The brine drying and salt storage areas are covered and are curbed. All of the hazardous waste storage tanks used for processing agent or other waste liquids have steel support legs that elevate the tank bottom above the top level of the curbing.

8.1.4 Method of Preventing Contamination of Water-Supplies

Back flow preventer systems are installed at potential cross connections to preclude any back flow of contaminated liquids into the potable water distribution system. These systems are installed and maintained in accordance with the Utah Public Drinking Water Rules, Section R309-102-5, under the Authority of the Utah Division of Drinking Water.

Ground water contamination is prevented by providing curbed containment areas under each liquid waste holding tank, and/or sloped, sealed concrete floors, which drain, into containment sumps. These precautions prevent waste liquid run-off in the event of container leakage.

8.1.5 Water for Fire Control

There are several fire sprinkler systems at CAMDS. The Unpack Area (UPA) Fire Sprinkler System has nine heads, a required flow of 400 gpm, and a required pressure of 15 psi. The Equipment Test Facility (ETF) Fire Sprinkler System has 50 heads, a required flow of 400 gpm, and a required pressure of 15 psi. The Rocket Line Fire Deluge System has eight heads, a required flow of 128 gpm, and a required pressure of 15 psi. The ETF Fire Deluge System has 20 heads, a required flow of 317.1 gpm and a residual pressure of 26.6 psi. Adequate water capacity for the CAMDS sprinkler systems is available from the Deseret Chemical Depot supply system.

8.1.6 Decontamination and Emergency Equipment

CAMDS has decontamination and emergency equipment located in the immediate vicinity. If a large spill were to occur, the facility would be supported by Deseret Chemical Depot decontamination teams.

There are two tanks for storage of the decontamination solution for agents GB and VX.

Truck mounted decontamination units with decontaminants for GB, VX, and mustard agent are available to support CAMDS. These are maintained by Deseret Chemical Depot Ammunition Storage Division for CAMDS and munition storage missions. An ambulance is maintained at the CAMDS Site Medical Facility (SMF) and two additional ambulances plus one patient transport vehicle are available from the DCD Medical Aid Station. Also two additional ambulances plus two patient transfer vehicles are available at the TEAD Dispensary. Evacuation busses include one at CAMDS and an additional three busses at DCD. Emergency equipment available from the DCD Fire Station

includes a tanker, a pumper truck, a rescue truck and a service vehicle. Additional emergency equipment available from the TEAD Fire Station includes a brush truck, a HAZMAT truck and trailer, a rescue truck, an area ladder truck w/pumper, a pumper truck and a service vehicle.

8.1.7 Aisle Space Requirements

All areas of the facility are accessible via the fully paved road system. This road system is capable of handling and permitting the unobstructed movement of personnel, fire protection, spill control, and decontamination equipment to any operating area of the facility in an emergency. Facility operating procedures prohibit the obstruction of roadway areas.

The buildings are designed to provide immediate access to the exit doors. Storage of containerized hazardous waste and waste piles occurs in designated areas at CAMDS. The contents of these storage facilities are arranged in aisles, which are wide enough to provide ample access for personnel, forklifts, fire protection equipment, and spill control equipment. At the MHA, munitions are stored on pallets and are surrounded by adequate aisle space for emergency response, inspections, and personnel movement. In the event of a spill, the spilled material would be neutralized and the munitions in the area would be decontaminated with decontamination solution. The munitions would then be removed before the final cleanup of spill residues. In the event of a fire, personnel would be evacuated from the MHA, and the fire would be allowed to burn out.

8.2 MEASURES TO PREVENT UNDUE EXPOSURE OF PERSONNEL TO HAZARDOUS MATERIALS AND OPERATIONS

8.2.1 Operations and Materials

The cardinal safety rule in accomplishing hazardous disassembly during testing of munitions is to work on the minimum number of munitions with the least number of operators for the shortest possible time. CAMDS complies with this by accomplishing all testing operations that are considered hazardous within an Explosive Containment Cubicle (ECC). The ECC isolates the disassembly operation from all operators. In the event of propellants or explosives being initiated during disassembly, the blast overpressures, agent, and fragments will be totally contained within the ECC. The ability of the ECC to contain agent, fragments, and overpressures has been proven by dynamic tests using simulant filled, 8-inch projectiles with a normal explosive charge plus a 25 percent overcharge. There are two ECC enclosures at CAMDS; ECC#1 is located adjacent to the Unpack Facility and the DFS, ECC#2 is located within the Equipment Test Facility.

Removal of burster wells from projectiles and penetrating bulk items for access to their agent is performed in unmanned, ventilated and shrouded areas.

8.2.2 Air Filtration

All toxic operating areas where agent may be present are ventilated. The ventilation system not only enhances the safety of all workers throughout the site, but also prevents fugitive agent emissions to the environment. For that reason, the filter units were

designed for and are operated continuously.

8.2.3 Hazardous Area Identification

Each of the CAMDS operating areas where agent could be present have been evaluated and assigned a specific hazard designation. These assigned hazard designations are conspicuously posted to prevent operator entry into a contaminated area without appropriate protective clothing. The designations range from Level A (most hazardous) to Level F (least hazardous).

8.2.4 Personnel Protective Clothing and Equipment

The use of personal Protective Clothing and Equipment (PCE) is the least desirable method of complying with Airborne Exposure Limits (AELs). Efforts will be made to reduce dependence upon PCE in agent operating environments through the increased use of engineering and administrative controls such as ventilation, isolation, remote operations and monitoring, and elimination of all nonessential entries into agent areas. Risk assessments will reflect that these alternatives have been explored.

The use of protective clothing can itself create significant worker hazards, such as heat stress, physical and psychological stress, and impaired vision, mobility, and communication. For any given situation, equipment and clothing should be selected that provides an adequate level of protection. However, specifying too high a level of protective clothing or too low a level of protective clothing can be hazardous and should be avoided where possible.

8.2.4.1 Protection levels

Selection of protective clothing is a complex process, which should take into consideration a variety of factors, including hazard identification, routes of exposure (inhalation, skin absorption, ingestion, and injection), and the performance of the materials in providing a barrier to these hazards. Other factors in this selection process are matching protective clothing to work requirements and task-specific conditions, task duration, and heat stress. These factors shall be considered in the risk assessment or hazard analysis for every agent operation. The following are definitions of levels of protection for chemical workers as taken from DA PAM 385-61, Toxic Chemical Agent Safety Standards, dated 27 Mar 2002 (Chapter 4):

8.2.4.2 Level A

Level A or Demilitarization Protective Ensemble (DPE) is selected when the greatest level of skin, respiratory, and eye protection is required. Level A protection shall be used when:

1) The hazardous substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system on the basis of either the measured high concentrations of atmospheric vapors, gases, or particulate; or the high potential of the site operations and work functions for splash, immersion, or exposure to unexpected vapors, gases, or particulate of materials harmful to skin or capable of being absorbed through the skin in harmful doses.

2) Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible at hazardous levels.

3) Operations are conducted in confined, poorly ventilated areas, and the absence of conditions requiring level A have not yet been determined.

Level A consists of: Positive-pressure, full-face piece, self-contained breathing apparatus (SCBA), or positive-pressure supplied-air respirator with escape SCBA, approved by the National Institute for Occupational Safety and Health (NIOSH); totally encapsulating (vapor-tight) chemical protective suit; coveralls (optional); gloves, outer, chemical resistant; gloves, inner; boots, chemical resistant, steel toe, and shank.

8.2.4.3 Level B

Level B is selected when the type and atmospheric concentration is known, and the highest level of respiratory protection is necessary, but a lesser level of skin protection is needed. Level B protection shall be used when the type and atmospheric concentration of substances have been identified and require a high level of respiratory protection, but less skin protection.

Level B consists of: NIOSH-approved, positive-pressure, full-face piece, self-contained breathing apparatus (SCBA); suit, hood; gloves, outer, chemical resistant; gloves, inner; boots, outer, chemical resistant, steel toe and shank; coveralls. Or, NIOSH-approved, positive-pressure, full-face piece, self-contained breathing apparatus (SCBA), or positive-pressure, supplied-air respirator with escape SCBA (NIOSH-approved); hooded, chemical-resistant clothing (overalls and long-sleeved jacket; coveralls; one- or two-piece chemical-splash suit; disposable chemical-resistant overalls); gloves, outer, chemical resistant; gloves, inner; boots, outer, chemical resistant, steel toe and shank; coveralls (optional); boot covers, outer, chemical resistant (optional); hard hat (optional); face shield (optional).

8.2.4.4 Level C

Level C, or military mask, is selected when the concentration(s) and type(s) of airborne substance(s) are known, and the criteria for using air-purifying respirators are met (as set forth in 29 CFR 1910.134(d), or AR 385-61, Table 2-1). Level C protection shall be used when the following conditions are met:

1) The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect or be absorbed through any exposed skin.

2) The types of air contaminants have been identified, concentrations have been measured, and an air-purifying respirator that can remove the contaminants is available.

3) All criteria for the use of air-purifying respirators or military masks are met.

Level C consists of: Full-face, air-purifying respirators (NIOSH-approved or military mask); hooded chemical-resistant clothing (overalls; two-piece chemical-splash suit;

sleeved chemical-resistant apron; disposable chemical-resistant overalls); gloves, outer, chemical resistant; gloves, inner; boots, outer, chemical resistant, steel toe and shank; coveralls (optional); boot covers, outer, chemical resistant (optional); hard hat (optional); face shield (optional).

8.2.4.5 Level D

Level D protection shall be used when the atmosphere contains no known hazard and work functions reasonably preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.

Level D consists of: NIOSH-approved or military mask slung or readily available; coveralls, fatigues, or equivalent government-issued clothing (laboratories may use a lab coat); boots/shoes, chemical resistant, steel toe and shank (optional); boots, outer, chemical resistant (optional); safety glasses or chemical splash goggles (optional); gloves (optional); hard hat (optional); face shield (optional). Non-chemical workers can wear street clothes with a slung mask in lieu of level D.

Based on local risk assessment deviations from the requirements stated above, combinations of PCE may be used to provide more proper and appropriate levels of protection.

8.3 METHODS OF MITIGATING THE EFFECTS OF EQUIPMENT AND POWER FAILURES

8.3.1 Equipment Failure Detection

Detection of equipment failure is a function of the CAMDS control system. The control system is designed and operated to perform shutdown of the entire CAMDS facility or a portion of the facility should a failure occur. A description of this system is provided in the following paragraphs.

The process control systems operate by using Programmable Logic Controllers (PLCs) and graphic terminals with a mouse and keyboard for operator interface. Site monitoring and data collection is done on the graphic terminals. Environmental Protection Agency (EPA) data collection is collected on its own designated computer, which sends an alarm bit to the process if certain parameters are not met. Each process is controlled by its own PLC, which is programmed for that specific purpose. The operator can control the process, or a part of the process, by using the mouse or keyboard.

The process control systems at the CAMDS facility are designed as a fail-safe system. All PLCs are configured fail-safe by turning OFF outputs when the PLC faults. Devices controlled by these outputs are configured as fail-safe devices. The status of the PLC is displayed on the graphics terminals. Communication to the graphic terminals is monitored and the status is displayed on the graphics system. Each process has at least three graphics systems, so that if one malfunctions there are two systems for operator control. PLCs have Electrically Erasable Programmable Read Only Memory (EEPROM) backup, which will reload a program if the PLC Random Access Memory (RAM) goes bad.

The control systems are checked for interlock operations before processing. After verifying the interlock system, the operator may start the process. Critical failures of equipment result in automatic shutdown of the process, which the equipment is interlocked to. This shutdown could be partial or complete, depending on the nature of the failure. Pre-alarms or indications are shown on the graphic terminals, for operators to prepare or respond to upset conditions. During a new process-testing phase, system interlocks and shutdowns will be developed and implemented. The data collection system will log all alarms, which can be analyzed for malfunction reports, maintenance reports, etc.

Process instrumentation has been designed to respond to process parameter changes within a few seconds. Operator responses to alarms occur immediately after recognition. Corrective actions are taken to prevent the alarm condition from escalating into an emergency condition.

8.3.2 Inspection

The time lags for an emergency situation that is detected by monitoring instrumentation (as opposed to inspection) are expected to be less than ten minutes before corrective action is initiated. An emergency event detected by inspection or observation will result in faster response. This response time is adequate to protect human health and prevent migration of agent, in harmful quantities, off-site. The response time is adequate to prevent destruction of the equipment and resultant release of hazardous waste to the environment. In the event that an emergency situation is announced, the following are steps to avoid overload from normal operations and emergency situations:

- The Plants operators will immediately don protective masks or other protective equipment.
- The operators leave the immediate area of a release or emergency and notify the On-Scene Commander (OSC). The initial OSC is the Control Module Operator (CMO).
- The operators shut off feed of waste to an affected unit or stop transfer of waste.
- The operators follow established SOPs for the affected unit to place the unit in a safe condition for unattended operation.
- The operators cease other work that can be left unattended.
- The operators assess the type of emergency and communicate this to the OSC.
- The OSC calls in local assistance teams from DCD, Maintenance Branch, or other resources as appropriate, or implements the contingency plan, as needed.
- The emergency rescue team follows the directions of the OSC to execute specific tasks to minimize the extent of the emergency and to restore control.
- The emergency rescue team cleans up any residuals from the emergency, containerize different residuals in separate containers, label each container, and set them aside in a secured area pending a decision on the part of the OSC on further disposition.

8.3.3 Incineration Upset Control

The incinerator control systems provide continuous, automatic control of each incineration process. System interaction by the operator is limited to initiation of process systems or reaction to abnormal conditions. In monitoring critical functions, the process control system will give advanced warning that an alarm condition is developing and warn operators in time to take corrective action. Interlocks are provided to respond to various conditions. Shutdown in the event of equipment failure can be immediate or staged. All incinerators have automatic feed cutoff systems.

8.3.4 Emergency Power

CAMDS emergency power system consists of diesel-engine-driven emergency standby generators. These systems are capable of carrying the entire CAMDS emergency load and providing backup power to all of the critical and essential loads in case of a power outage. Failure of commercial power is sensed by automatic transfer switches that start each generator and switch critical loads to standby power within ten seconds after a power failure.

Emergency power is provided to all critical functions, i.e., the control system, agent monitors, emergency lighting, plant and life support air compressors, ventilation filter units, communication systems, Closed Circuit Television (CCTV) systems, induced draft fans, PAS equipment, agent processing equipment, guardhouse, and perimeter lighting. The process control system automatically brings operations to a standby mode during emergency power utilization.

8.3.5 Communication Systems

Several independent systems are incorporated into CAMDS to provide uninterrupted communications during normal operations, and under emergency conditions.

Radios are available for communication within the facility. The telephone system (with dual capability for both local use within CAMDS and commercial use through U. S. West) and the radios are available at the scene of operations. The telephone system would be used for summoning emergency assistance from local police or fire departments, as well as, state or local emergency response teams. Public address announcements can be made from any of the local telephone units.

CCTV cameras monitor critical steps in the demilitarization process. Wherever possible, direct viewing between observation areas and agent processing areas is provided.

The operators in DPE suits are in constant voice or visual contact with the support team immediately outside the toxic area. The support team can contact the CMO either with radios or telephone.

Speakers are installed throughout the plant so that all personnel can hear announcements made over the public address system. An area alarm that is easily heard in all areas of the plant can be activated from the CMO in emergency situations.

In addition to voice communications, emergency alarms for fire, explosion, power failure, agent release, etc., are sounded. Based on the alarm pattern that is sounded, personnel are to don their protective masks and follow evacuation procedures.

Alarm signals are also transmitted to DCD emergency facilities (security, fire department, etc.).

8.4 AIR QUALITY MONITORING NETWORK

8.4.1 General

The air emissions from CAMDS exhaust stacks are treated with pollution abatement systems in order to meet all environmental standards. The combustion Allowable Stack Concentration (ASC) for agents are shown in Table 8-2. All of the operating building areas of CAMDS are also monitored for the presence of agents. Agent standards for working areas are also shown in Table 8-2.

The building operating areas where there is any probability of agent, in any amount, are contained and ventilated. The air drawn from these areas is filtered through high efficiency particulate air and charcoal filters before being exhausted to atmosphere. The filter units are monitored for agent breakthrough. The building interior monitors provide early warning that agent is present at the levels shown in Table 8-2, facilitating immediate corrective action, and minimizing the agent load to the filters.

8.4.2 CAMDS Site Source Air Monitoring

The exhaust stack from each incinerator that burns agent is continuously monitored for the agent being processed and causes alarms to sound at the levels shown in Table 8-2. The characteristics of these monitors are described in the following paragraphs.

TABLE 8-2
AGENT STANDARDS FOR
STACK EMISSIONS AND WORK AREAS

Agents	Concentration (mg/m3) Based on 8-hour Time-Weighted Average	Allowable Stack Concentration (mg/m^3)	IDLH [b] (mg/m^3)
Mustard	0.003	0.03	[c]
VX	0.00001	0.0003	0.02
GB	0.0001	0.0003	0.2
GA	0.0001	0.0003	0.2
L	0.003	0.03	[a]

Notes:
a IDLH values for L have not been established by DOD or DHHS.
b IDLH values for GB, GA, and VX are listed in AR-385-61.
c Gross Level Detector (GLD), value for mustard is 0.2 mg/m3.
OtherNotes:
mg/m3 = milligrams per cubic meter
IDLH = immediately dangerous to life and health

There are eleven air quality-monitoring stations, located as shown in TCDS 29-100-01 (see Attachment 11). All eleven stations monitor the ambient air for the presence of agent for historical purposes. Wind speed and direction are measured at nine of these stations. Data relative to wind speed and direction measured at each station is telemetered to the depot computer bank at DCD Building No. 5108. Each of the air monitoring stations is8 feet wide by 16 feet long. The buildings are air conditioned and heated to maintain a constant temperature in the range of 68°F to 86°F. The approved limits for general population exposure to chemical agents are shown in Table 8-3.

Agent sampling is performed by sequential samplers set to take two 12-hour samples per day. The air sample is taken by Depot Area Air Monitoring System (DAAMS), or equivalent. The sampling setup provides a primary and backup air sample for each sampling period. If any measurable trace of agent is detected in the primary sample, the backup sample is analyzed. The backup sample is not analyzed if there is no positive result from analysis of the primary sample. The DAAMS are collected and replaced daily. Analysis of the samples is performed by qualified chemists in the CAMDS laboratory. Calibration of the sequential samples is performed by weekly inspection of the critical orifice.

TABLE 8-3
AGENT EXPOSURE LIMITS AND AGENT STACK LIMITS

Location	CHEMICAL AGENT CONCENTRATIONS (mg/m^3)				
	GA	GB	H/HD/HT	L	VX
Maximum Allowable Stack Concentration[1,2]	0.0003	0.0003	0.03	0.03	0.0003
General Population Limit[1,3] (Averaging Time 72 Hours)	0.000003	0.000003	0.0001	0.0001	0.000003
Work-place Time Weighted Average[1,3] (Averaging Time 8 Hours)	0.0001	0.0001	0.003	0.003	0.00001

Notes:

1 Public Law 91-121/144 (USC 1512) mandates that the United States Department of Health and Human Services (HHS) review the plans for transporting and/or disposing of lethal chemical agents and make recommendations for protecting human health and safety. HHS delegated review and recommendation authority to the Centers for Disease Control (CDC).

2 The Department of Army proposed the maximum allowable stack concentrations. HHS reviewed the concentrations and announced in the March 15, 1988 Federal Register (53 FR 8504) [corrected in 53 FR 11002, April 4, 1988] that the concentrations "met HHS criteria and appear to be more restrictive than limits set on a health basis alone", and therefore made no recommendation for changes.

3 The March 15, 1988 Federal Register (53 FR 8504) [corrected in 53 FR 11002, April 4, 1988] announced that CDC concluded that the concentrations indicated will adequately protect human health; "even long-term exposure to these concentrations would not create any adverse health effects."

Other Note:
CDC determined that the current available data precluded acceptable exposure limits for mustard agents from being precisely defined. CDC concluded that the work-place limits will amply protect a general population 1000 meters or more from the demilitarization site or transportation route. Therefore, protection of the general population is dependant upon meeting the work-place limits within the facility.

8.4.3 Agent Detection Equipment

Agent detectors are used throughout CAMDS operating buildings to monitor the area and provide warning to the operators in the event of agent leakage. The following excerpts from CAMDS fact sheets describe the purpose, operation and capability of these two monitoring systems.

8.4.4 Automatic Continuous Air Monitoring System

8.4.4.1 General

The Automatic Continuous Air Monitoring System (ACAMS) detector is capable of detecting nerve agents GB and VX, and blister agent HD at the Immediately Dangerous to Life and Health (IDLH), the Allowable Stack Concentration (ASC), and the Time-Weighted Average (TWA) limits set by the U.S. Surgeon General for unmasked workers. The ACAMS consists of the monitor, sampling pump, strip chart recorder, and gas cylinders.

8.4.4.2 Theory of Operation

The ACAMS unit uses gas chromatography to separate the agents from interferants and to detect the agent by use of a flame photometric detector. The ACAMS unit operates in two-cycle modes. In the SAMPLE mode, air is drawn into the instrument through a preconcentrator tube, which contains a solid sorbent material. When monitoring VX, the sample first passes through a filter, which converts any VX present to the ethyl analog of GB. The sorbent (at approximately 50°C) scrubs the chemical agents from the air stream. Upon completion of the SAMPLE period, the detector automatically switches to the PURGE mode. A heater surrounding the preconcentrator turns on and thermally desorbs (at approximately 190°C) compounds that have been collected. These compounds are transported to the analytical column by nitrogen carrier. The analytical column separates the various compounds chromatographically, because compounds of different molecular weights travel at different rates. The compounds are then detected by a flame photometric detector. The detector flame is supported by hydrogen and air. As the various compounds enter the detector flame, the light emitted is detected by a photomultiplier tube, whose signal is transmitted to a recorder and alarm circuit. The photomultiplier signal is directly proportional to the level of agents GB and VX detected. A linearizer circuit is activated when monitoring HD.

8.4.4.3 Sensitivity and Response Time

	TWA or ASC	**IDLH**	**Gross Level Detector**
Sensitivity			
VX	0.00001 mg/m^3	0.02 mg/m^3	--
GB:	0.0001 mg/m^3	0.2 mg/m^3	--
Mustard	0.003 mg/m^3		0.2 mg/m^3
Response Time			
VX	5 minutes	3 minutes	
GB	3 minutes	2 minutes	
Mustard	3 minutes	2 minutes	

8.4.5 Depot Area Air Monitoring System

8.4.5.1 General

The Depot Area Air Monitoring System (DAAMS) is a sampling and analysis technique capable of detecting chemical agents GB, HD, and VX in ambient air at the TWA limits established by the U.S. Surgeon General for unmasked workers and at the General Population Limit (GPL) for perimeter stations. The technique can also be used to monitor stack gases with a stack sampling apparatus to lower the stack gas dew point below 50°C. Analyses must be performed in a laboratory.

8.4.5.2 Theory of Operation

The DAAMS technique is based on solid sorbent preconcentration of air sampled followed by thermal desorption and analysis by gas chromatography using a flame photometric detector. This is also the principle upon which the ACAMS is based. The solid sorbent tube is connected to a vacuum pump through a flow control device. When monitoring GB and HD, the sample vapors are passed directly into the sorbent tube, whereas in the case of VX, the vapors first contact a V to G conversion pad. The conversion pad is a non-woven polyester felt, coated with silver nitrate and potassium fluoride, which reacts with VX to form the G-analog, ethylmethylphosphonofluoridate. The G-analog then is adsorbed onto the sampling tube. VX and GB are sampled using Chromosorb 106 or Haysep as the sorbent and HD is collected on Tenax GC. The DAAMS tubes are then manually or automatically inserted into a heated inlet where the contents are desorbed into a transfer tube. The sorbent material in the transfer tube is the same as in the respective DAAMS tube. The transfer tubes are then desorbed into a gas chromatograph. A flame photometric detector equipped with a phosphorous bandpass filter is used to detect GB and the G-analog of VX. A sulfur bandpass filter is used to detect HD. Knowing the amount of agent on the sorbent tube and the total volume or air sampled, the average agent concentration in the air can be calculated. By increasing the sample time and/or flow rate, the average concentration sensitivity can be increased. Agent sensitivity and response times follow.

8.4.5.3 Sensitivity and Response Time

	TWA	ASC	GPL
Sensitivity			
GB	0.0001 mg/m^3	0.0003 mg/m^3	0.000003 mg/m^3
Mustard	0.003 mg/m^3	0.03 mg/m^3	0.0001 mg/m^3
VX	0.00001 mg/m^3	0.0003 mg/m^3	0.000003 mg/m^3
Transport & Analysis	**Time:[1]**		
GB	8 hr	8 hr	16 hr
Mustard	8 hr	8 hr	16 hr
VX	8 hr	8 hr	16 hr

Notes:
[1] Total response time is the sample time plus transport & analysis time. Transport and analysis time is as shown. Sample time for TWA is either 2 or 12 hours. Sample time for ASC is 4 hours. Sample time for GPL is 12 hours.

8.5 PREVENTION OF ACCIDENTAL IGNITION OR REACTION OF IGNITABLE, CORROSIVE, OR REACTIVE WASTES

A number of general precautions are taken at CAMDS to prevent the accidental ignition or reaction of ignitable or reactive wastes. In addition, similar operational safety considerations are accounted for in the design of the CAMDS processes.

8.5.1 General Precautions

Permits for welding are required to contractors by the contracting officer. Before any welding or other hot work can begin, all munitions must be removed from the area.

The munitions are taken to the UPA, MHA, or the ETF. The explosive components, or energetic materials, are handled according to Army standards:

- AR385-61, The Army Chemical Agent Safety Program, dated 12 Oct 01
- DA PAM 385-61, Toxic Chemical Agent Safety Standards, dated 27 Mar 2002
- DOD 6055.9-Std, Ammunition and Explosives Safety Standards, dated August 1997.
- AR 385-64, U.S. Army Explosives Safety Program , dated 01 Feb 00.
- DA PAM 385-64, Ammunition and Explosives Safety Standards, dated 15 Dec 99.

These standards outline specific procedures and practices that are put into place to prevent energetic material emergencies. There are specific quantity/distance relationships in these standards that apply to the explosive components handled at CAMDS.

Within the installation, and specifically within the CAMDS, smoking is permitted only in specifically designated areas. Signs are posted at the front gate to prohibit smoking except for these specially designated areas.

8.5.2 Operational Safety Considerations

All ignitable material treated, stored, or disposed of at CAMDS is segregated by type and protected from open flame, smoking, cutting and welding areas, hot surfaces, frictional heat, sparks (static, electrical, or mechanical), exothermic chemical reactions, or radiant heat. Waste is combusted only in the controlled and contained environment within the CAMDS incineration processes.

An extensive ventilation system at CAMDS controls toxic or flammable mists, fumes, dusts, or gases that may be produced in sufficient quantities to threaten human health or the environment. The system operates continuously, thus ensuring that an explosive accumulation of gases does not occur. Contaminated air is drawn into particulate filters and activated charcoal beds, while fresh air is drawn into the affected area. The ventilation system uses a standard butterfly damper with a spring return on the positioner. The fail safe is if electrical signal or instrument air is lost the damper goes to its fail safe position, either closed or open depending on where it is installed in the system. Butterfly dampers installed in the perimeter walls fail safe (spring return) to the closed position to prevent the migration of mists, fumes, and dusts to the environment. Interior butterfly dampers fail safe to the open position to take advantage of the site ventilation and filter system. This prevents reverse flow and isolates toxic areas in the event of inadequate airflow or loss of electrical signal. Panels and alarms in the CMO indicate air pressure in ventilated areas and flow through the charcoal filters.

Several design features of the processes at CAMDS protect against damage to facility structures and reduce the risk of munition explosions. Use of equipment having the appropriate electrical classification is maintained throughout the site or the process is contained in an Explosion Containment Cubicle. Devices that handle, disassemble, or transport munitions are specially designed for their respective purpose. Equipment in ECC No. 1, Projectile Disassembly Facility (PDF) containing the Multipurpose Demilitarization Machine (MDM), and ETF (including ECC No. 2) can be adapted for each type of munition.

A combination of remote monitoring and computer control allows inspection and verification of each functional step in the demilitarization process. For example, a CCTV in the Bulk Item Loading Station allows operators to observe remote-controlled conveyor transfer sequences through the conveyor airlock. Mechanical systems and conveyors for the following items are also remotely controlled and have additional computer control for fail-safe operation:

Rocket draining and shearing

- Mine burster and agent removal
- Mortar burster removal

- Projectile burster removal and cutting

Structures in which munitions are demilitarized or thermally destroyed are designed to contain detonations and deflagration in the unlikely event of an explosion. The ECC is capable of safely retaining fragments and chemical agents from an explosion of the worst-case munition during the demilitarization process.

The techniques and procedures used to prevent accidental ignition or explosions at CAMDS are documented by knowledge of the explosives and chemical agents to be incinerated and 70 years of experience accumulated by the U.S. Army in the handling and demilitarizing of such materials.

8.5.3 Management of Ignitable or Reactive Wastes in Tanks

Precautions are taken to ensure that there is no deliberate or accidental contact of chemical agent with incompatible materials. Only one agent type is processed in a particular tank.

Chemical agents are stored in tanks dedicated to this service. The agent tanks and related piping do not have any other piping by interconnections with any source of water or spent decontamination solution.

All agent tanks store only one chemical agent at a time. All agent tanks are drained of agent, decontaminated, drained of spent decontamination solution, rinsed, and drained of rinse water before being used to store a different agent. The vapor space of the empty tank is checked with a sampling device to confirm agent removal before another agent is added. All rinse waters (spent decontamination solution and water) will be handled as hazardous waste and incinerated or sent to an approved treatment, storage, and disposal facility.

The National Fire Prevention Association (NFPA) buffer zone requirements are easily met by CAMDS. The NFPA requires that tanks less than 1,000 gallons be located 50 feet from the property line. At CAMDS, there are 30 feet between the security fences, and the storage tanks are located at least 100 feet from the nearest fence. CAMDS is located 2,500 feet from the DCD fence line.